

Extended Abstract – AAS/AIAA Space Flight Mechanics Meeting
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CASSINI ORBIT RECONSTRUCTION FROM EARTH TO JUPITER

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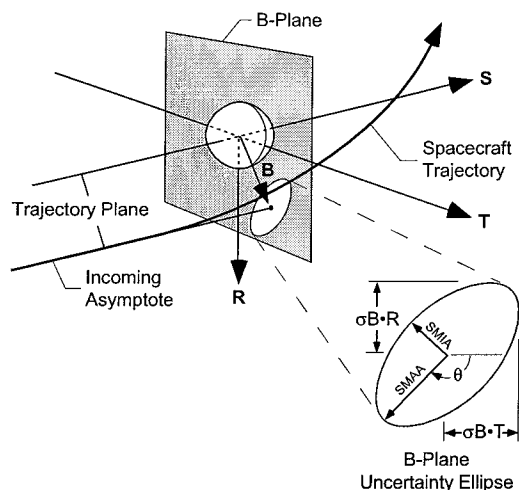
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The purpose of the Cassini mission is to study Saturn and its satellites, rings, and magnetosphere. To accomplish this mission, Cassini's interplanetary trajectory includes gravity assists from two Venus flybys, an Earth flyby, and a Jupiter flyby before injection into orbit around Saturn on 1 July 2004.

Cassini successfully completed its fourth and final planetary gravity assist with closest approach to Jupiter occurring on 30 December 2000 10:04:21.870 UTC. Flying past Jupiter at a periapsis altitude of 9,722,965 km, a ΔV of 2.2 km/s was imparted to Cassini while bending its trajectory by 12.2° . The Earth to Jupiter leg of the Cassini mission was extremely successful as all orbit determination goals and requirements were met. Of the four planned trajectory correction maneuvers between the Earth and Jupiter flybys, only the first two were executed. The last two pre-Jupiter maneuvers were cancelled as the computed spacecraft trajectory was very close to the reference trajectory.

Cassini's position relative to Jupiter at closest approach, mapped to the Jupiter B-plane*, was $B \cdot T = 10,896,977$ km and $B \cdot R = 123,778$ km. Formal filtered uncertainties yielded a B-plane error ellipse with a semi-major axis of 115 km, semi-minor axis of 0.6 km, and an orientation angle of 90.7° . The one sigma uncertainty in the time of closest approach was 0.08 seconds.

A detailed reconstruction of Cassini's trajectory from Earth flyby to Jupiter flyby will be described in this paper. The spacecraft trajectory will be characterized first, followed by a description of tracking data and *a priori* models. Reconstructed values will then be presented, accompanied with the resulting tracking data residual plots.



*The B-plane is a plane passing through the center of the target body and perpendicular to the incoming asymptote of the hyperbolic flyby trajectory. Coordinates in the plane are given in the R and T directions, with T being parallel to the Earth Mean Orbital plane of 2000. The angle θ determines the rotation of the semi-major axis of the error ellipse in the B-plane relative to the T -axis and is measured positive right-handed about S .

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